Physics of thermalization and level density in an isolated system of strongly interacting particles

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Statistical physics of isolated systems of strongly interacting constituents is an important part of all practical applications, including astrophysics and technology. Two aspects will be discussed: level density and time-dependent process of thermalization. Recent experiments in nuclear reactions show that the nuclear level density is well described, up to some excitation energy, by a pure exponential function of energy (the so-called "constant temperature model"). The same conclusion follows from the exact shell-model diagonalization. The underlying physics is related to the process of chaotization of many-body dynamics. The role of superfluid pairing, collective modes, random spin coupling, and incoherent collision-like interactions is discussed. The time-dependent evolution of an initial non-equilibrium state shows an analogy to the radioactive decay of unstable systems. The majority of initial states undergo the typical decoherence process similar to what is characteristic for random ensembles.

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